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(71) Applicant: BIOBREAK, INC. [US/US]; 10 Pine Island Shores, Summerton, SC 29148 (US).

(72) Inventor: VERMEIREN, J., J., R.; 8 Vrouwstraat 19, B-2300 Turnhout (BE).

(74) Agent: MANN, Michael, A.; Michael A. Mann, P.A., P.O. Box 7908, Columbia, SC 29202 (US).

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(54) Title: METHOD AND COMPOSITION FOR TREATING WASTE IN A SEPTIC SYSTEM

(57) Abstract

A composition and method for preparing a biodegradable, stable, dual-enzyme composition, and method for making the same for treating waste in a septic system. The liquid composition comprises a boron compound, a poly-alcohol compound, an alkali metal salt, a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and water. In addition, the present invention is a method for decomposing, disinfecting and deodorizing a septic system using the stabilized enzymatic composition. Further, the present invention is a septic system for collecting and decomposing waste using the enzymatic composition.

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METHOD AND COMPOSITION FOR TREATING WASTE IN A SEPTIC SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a method for treating waste in a septic system. The present invention also relates to an enzymatic composition for treating waste in a septic system and a method for preparing the enzymatic composition. In addition, the present invention relates to a device for collecting, decomposing, disinfecting and deodorizing waste in a septic system. In particular, the present invention relates to a method for treating waste in a septic system with an enzymatic composition that enhances decomposition of the waste allowing for the waste to be safely discarded.

2. Discussion of Background:

The use of enzymes to decompose proteins and cellulose products is well known. Because of their ability to decompose proteins, starches, cellulosic materials, fats, urine and peptides, enzyme-containing compositions have been used in cleaning applications, such as laundry detergents and household cleaners.

However, because enzymes often lack stability in the presence of certain chemicals, obtaining a satisfactory storage-stability for enzymes

in cleaning compositions has been the subject of much research. In addition to being unstable in the presence of certain chemicals, enzymes may also be subject to digestion by protein digesting enzymes, such as protease enzymes. As a result, enzymes are not stable in many compositions and, therefore, cleaners containing enzymes fail to have a sufficient storage life for practical use. Furthermore, dry enzyme compositions are not desirable because they are expensive to produce and they provide dusting problems.

Various materials have been used to enhance the stability of enzymes in differing liquid compositions, such as alcohols, polyols, acids, fatty acids, water soluble salts and sugars. In addition, boron compounds have been used to enhance the stability of enzymes such as cellulase against the digesting effect of the protease enzyme. For example, the detergent taught in Pan, et al., in U.S. 5,332,528, comprises enzymes stabilized by boron compounds, sodium salts and poly-alcohols. In addition, Pan, et al. broadly disclose other compounds that act as stabilizers, surfactants, soil release agents, detergent builders, bleaching compounds, dispersing agents, enzymes and other detergent additives.

Connor, et al., in U.S. 5,223,179, disclose a cleaning composition with glycerol amides. Connor, et al. disclose the use of alkali metal borates, sodium salts, protease, cellulase, amylase, lipase and peroxidases enzymes, in addition to many other detergent additives. Eriksen, et al., U.S. 5,286,404, disclose the use of aldehyde treatment, acylation, or alkylation of the amino group of an enzyme to improve the solubility of the enzyme. Eriksen, et al. also disclose the use of boron compounds, sodium salts and polyalcohols in conjunction with the modified enzymes.

However, the compositions disclosed in Pan, et al., Connor, et al. and Eriksen, et al. are not used in a septic system, but are used as laundry detergents, dishwashing liquids, shampoos, bar soaps and hard surface cleaners.

Boskamp, U.S. 4,462,922, discloses an enzymatic liquid detergent composition that comprises a known enzymatic-stabilizing system which comprises a mixture of boric acid or an alkali metal borate with a polyalcohol or a polyfunctional amino compound, together with an alkali metal salt such as sodium sulphite to stabilize the enzyme.

Bruno, et al., U.S. 4,566,985, disclose a liquid enzyme cleaning composition that comprises a water based solution containing a protease enzyme and at least one other enzyme. Bruno, et al. teach the use of benzamidine hydrohalide to inhibit the protease enzyme from digesting the other enzyme present in solution. In addition, poly-alcohols, non-ionic preservative, bacteriastat and sodium salts are used in the cleaning composition.

Many other enzymatic compositions contain soaps, a wide variety of surfactants, soil release agents, detergent builders, bleaching compounds, polymeric dispersing agents, chelating agents, brighteners, suds suppressers, as well as other ingredients used in detergents. For example, Hora, et al., in U.S. 4,261,868, teach a stabilized enzymatic liquid detergent composition containing a polyalkanolamine and a boron compound. Tai, U.S. 4,404,115, shows a enzymatic liquid cleaning composition and Estell, U.S. 5,039,446, discloses a liquid detergent with stabilized enzymes.

Furthermore, examples of other compositions containing stabilized enzyme systems include: Falholt, et al., U.S. 4,906,396, disclose protected enzyme systems, Eilertsen, et al., U.S. 4,543,333, teach enzyme stabilization using lower alcohols and organic acids, Ziffer, U.S. 3,717,550, shows liquid compositions of bacterial protease and/or amylase and their preparation, Shaer, U.S. 4,548,727, teaches aqueous compositions containing stabilized enzymes, Innerfield, U.S. 3,682,842, discloses stabilized enzymatic compositions containing protease and alpha amylase of bacterial origin and a method of stabilizing such compositions, and Shaer, U.S. 4,518,694, teaches aqueous compositions containing stabilized enzymes.

Moreover, enzyme-containing compositions can be used to digest solid waste. Fugua, et al., U.S. 5,326,477, teach a process for digesting solid waste with digestive enzymes. Enzymes are used to digest such solid waste as disposable diapers and under pads, paper, and food products.

In addition, Klingle, U.S. 3,624,665, discloses a miniature sanitary disposal plant that comprises a toilet and a self-contained disposal system. The sewage or other organic waste material in the disposal system is digested, purified, neutralized, and at least partially evaporated prior to the discharge of the remaining material.

Although enzyme compositions have been used in detergents, cleaning agents, digestion of solid wastes and other applications, the utility of protease and cellulase enzymes has not until the present invention been used in treating waste found in septic systems, nor has the combination of protease, cellulase enzymes and a disinfecting

composition (alkyl-diazalheptanic acid) been used as a digesting, disinfecting agent.

SUMMARY OF THE INVENTION

According to its major aspects and broadly stated, the present invention is a method and enzymatic composition for treating a septic system, in particular, a portable septic system. The method comprises combining an alkyl-diazalheptanic acid, a protease enzyme, a cellulase enzyme and carrier compounds to form a biodegradable enzymatic composition, then adding the enzymatic composition to a septic system. The method further comprises dissolving the solid enzymatic composition in water prior to addition of the enzymatic composition to the septic system. The method further comprises combining a boron compound, a poly-alcohol compound, an alkali metal salt, a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and water to form a biodegradable liquid enzymatic composition, then adding the enzymatic composition to a septic system. The septic system can be any type of septic system: a septic tank or portable septic system as is employed in a portable toilet, or a toilet carried by a vehicle such as an airplane or bus. The method additionally comprises collecting waste in the septic system and contacting the waste collected with the enzymatic composition prepared, so that the enzymatic composition decomposes the collected waste. The decomposed waste can subsequently be disposed of by any conventional method, such as disposal in a conventional septic system.

The present liquid enzymatic composition for treating waste in a septic system comprises:

(a) between approximately 20% and approximately 30% by weight of an approximately 20% solution of alkyl-diazalheptanic acid;

(b) between approximately 8% and approximately 20% by weight poly-alcohol;

(c) between approximately 4% and approximately 10% by weight alkali metal salt;

(d) between approximately 3% and approximately 5% by weight of a boron compound;

(e) between approximately 0.5% and approximately 2% by weight protease enzyme;

(f) between approximately 1% and approximately 4% by weight cellulase enzyme; and

(g) water.

Furthermore, the present invention is a method of preparing a liquid composition for decomposing a septic system. The method comprises the steps of preparing a first solution comprising a boron compound, a poly-alcohol compound, an alkali metal salt, and water. Once the first solution has been adequately mixed by agitating the mixture, protease enzyme, cellulase enzyme and alkyl-diazalheptanic acid are added to the first solution.

A primary feature of the present invention is the stability of both the protease and cellulase enzymes in solution, especially stability in the presence of a disinfecting agent. This feature assures a reasonable shelf life for the product.

The solid enzymatic composition for treating waste in a septic system comprises:

(a) between approximately 7% and approximately 14%, preferably approximately 10%, by weight of an approximately 20% solution of alkyl-diazalheptanic acid;

(b) between approximately 0.1% and approximately 1%, preferably approximately 0.4%, by weight of a protease enzyme;

(c) between approximately 0.4% and approximately 1.7%, preferably approximately .8%, by weight of a cellulase enzyme; and

(d) between approximately 84% and approximately 92%, preferably 89%, by weight of carrier compounds.

The present invention is additionally a septic system for collecting and decomposing waste. The septic system comprises a toilet for receiving waste, a means for collecting waste in fluid communication with the toilet, and a composition in the toilet and the collecting means wherein the composition includes a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and carrier compounds. The carrier compounds in the liquid composition can be the combination of a boron compound, a poly-alcohol compound, an alkali metal salt and water (as disclosed in detail above). Furthermore, the composition comprising a cellulase enzyme, a protease enzyme, an alkyl-diazalheptanic acid and carrier compounds can be a solid composition. If the composition is solid, the composition can be dissolved in water before addition to the septic system.

Another feature is that the composition and its constituents are selected from biodegradable substances; thus the composition itself is

readily biodegradable. The composition can be put into a septic system for use and will not contaminate the system.

In addition, a feature of the present invention is that the enzymatic composition used in the septic system is non-toxic, environmentally safe, biodegradable and therefore readily disposable. Moreover, once the enzymatic composition has decomposed the waste in the septic system, the contents of the septic system can be discarded in sewer systems without disturbing the biological balance maintained in the sewer system.

Other features and advantages of the present invention will be apparent to those skilled in the art from a careful reading of the Detailed Description of a Preferred Embodiment presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings,

Fig. 1 is a perspective view of a portable toilet according to a preferred embodiment of the present invention; and

Fig. 2 illustrates a cross sectional view of the portable toilet taken along lines 2-2 of Fig. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

According to a preferred embodiment of the present invention, the liquid enzymatic composition comprises between approximately 20% and approximately 30% but preferably approximately 25% by weight of an approximately 20% solution of alkyl-diazalheptanic acid; between

approximately 8% and approximately 20% but preferably approximately 10% by weight poly-alcohol; between approximately 4% and 10% but preferably approximately 4% by weight alkali metal salt; between approximately 3% and approximately 5% but preferably approximately 3% by weight of a boron compound; between approximately 0.5% and 2% but preferably approximately 1% by weight protease enzyme; between approximately 1% and approximately 4% but preferably approximately 2% by weight cellulase enzyme; and water.

It is important to note that a novel feature of the present invention is the stability of the liquid composition while retaining the desired decomposing and disinfecting properties. Because the protease enzyme digests other enzymes, much research has been aimed at the stabilization of enzymatic cleaning solutions containing protease enzymes and other enzymes. The present invention pertains to a stabilized solution containing a protease enzyme, a cellulase enzyme and a disinfecting agent in proportions sufficient not only to yield a stable composition, but also one that will decompose and disinfect the waste in a septic system and also will require no special disposal after use. Omission of one of these constituents of the enzymatic composition will diminish the decomposing, disinfecting and deodorizing ability of the composition as well as adversely affect the stability of the liquid composition.

Further, according to a preferred embodiment of the present invention, the alkyl-diazalheptanic acid has an alkyl group of between approximately 8 to approximately 14 carbons in length. The poly-alcohol is selected from the group consisting of ethylene glycol, propylene glycol, 1,2-propanediol, butylene glycol, hexylene glycol,

glycerine, mannitol, sorbitol, erythritol, glucose fructose, lactose, erythritol-1,4-anhydride and mixtures thereof. The boron compound is selected from the group consisting of boric acid, boric oxide and alkali metal borates and the alkali metal salt is sodium chloride.

In the most preferred composition, the alkyl-diazalheptanic acid has an alkyl group of twelve carbons, i.e., n-lauryl-4-amino butyric acid or dodecyl-amino-propyl-glycine, and is present in 25% by weight of a 20% solution; the poly-alcohol is glycerine and is present in 10% by weight; the alkali metal salt is sodium chloride and is present in 4% by weight; the boron compound is sodium borate and is present in 3%; the protease enzyme is equivalent to that sold under the trademark EXPERASE 8L-NOVO and is present in 1% by weight; the cellulase enzyme is equivalent to that sold under the trademark DENIMAX L-NOVO and is present in 2% by weight; and water present in approximately 55%.

The diazalheptainic acid provides the disinfecting and deodorizing effect of the enzymatic composition. In addition, the diazalheptanic acid acts as a surfactant, preventing surface action or sticking of wastes to the sides of a septic system in which the present composition is used. This surfacting action helps in the emptying of the septic system. Other surfactants can be used in combination with the diazalheptanic acid, or with other disinfectants. However, when using two different compounds, the stability, toxicity and biodegradability of the enzymatic composition must be considered.

The alkyl group present in the alkyl-diazalheptanic acid can be replaced by alkyl chains of different lengths, so long as the disinfecting

performance is adequate for the particular septic system. Other disinfectants can be used, such as quaternary compounds, but the use of quaternary compounds as opposed to the alkyl-diazalheptanic acid increases toxicity and decreases biodegradability of the composition. The other components of the composition should be adjusted accordingly depending on the disinfectant or surfactant used.

Best results are obtained from the disinfecting alkyl-diazalheptanic acid when the alkyl group is a straight chain alkyl group of twelve carbons. Branching of the alkyl group causes a decrease in the ability of the enzymatic composition to disinfect the waste in the septic system and decreases biodegradability of the composition. Altering the number and places of the carbons on the alkyl group of the diazaheptanic acid will affect three parameters of the resulting enzymatic composition product: the disinfecting capacity, the biodegradability, and the solubility of the resulting product in water. In addition, increasing the amount of alkyl-diazalheptanic acid used can increase the toxicity of the composition.

The poly-alcohol compound acts as a stabilizer for enzymes and a solubilizer for minerals. Glycerine is most preferred among the poly-alcohols listed because of its solubility. The alkali metal salt compound present in the composition also acts as a stabilizer for the enzymes. The most preferred alkali metal salt is sodium chloride. The destabilizing effect on the enzymes caused by the diazalheptanic acid and the water is compensated for by the glycerine and the sodium chloride.

The boron compound present in the composition acts to stabilize the enzyme solution. The boron compound protects the cellulase enzyme from the digesting action of the protease enzyme. Sodium borate is most

preferred, however, boric acid can be used if the pH of the solution is maintained within a working range for the enzymes (pH of between approximately 7 and approximately 9).

The enzymes present in the composition act to digest and decompose the waste present in a septic system, i.e., feces and cellulose products. The protease enzyme liquefies protein substances and the cellulase enzyme liquefies cellulose substances, such as paper. The liquefied product is easily disposed.

In its preferred embodiment the liquid composition designed for use in a portable toilet comprises 250 grams of a 20% solution of alkly-diazalheptanic acid, wherein the alkyl group is a straight chain of twelve carbons, 100 grams of glycerine, 40 grams of sodium chloride, 30 grams of sodium borate (borax), 10 grams of liquid protease (e.g. Experase 8L-Novo™), 20 grams of liquid cellulase (e.g. Denimax L-Novo™), and bring to (fill to) 1000 grams with water (approximately 550 grams of water). These amounts are set so that approximately 100-125 ml can be used to treat a portable toilet that has a total content of 20 liters.

The formula, however, may vary depending on the use, size of container or collecting means. Other possible formulas for the liquid composition are described in compositions I, II, III as follows:

Compound	I	II	III
alkyl-diazalheptanic acid 20%	350 gr.	250 gr.	125 gr.
glycerine	70 gr.	100 gr.	100 gr.

sodium chloride	40 gr.	40 gr.	40 gr.
sodium borate	30 gr.	30 gr.	30 gr.
liquid protease	14 gr.	10 gr.	5 gr.
liquid cellulase	28 gr.	20 gr.	10 gr.
water	fill to 1000 gr.	to 1000 gr.	to 1000 gr.

The enzymes are used in the same proportion as the disinfecting agent (alkyl-diazalheptanic acid). Water, sodium chloride, sodium borate and glycerine serve as vehicles or carriers for the active ingredients (the active ingredients include the alkyl-diazalheptanic acid and both the protease and cellulase enzymes). The proportions of the water, sodium chloride, sodium borate and glycerine are independent from the proportions of the active ingredients, as can be seen in the compositions above.

Decreasing the amount of the enzyme present in the composition will decrease the enzyme's ability to decompose waste. However, increasing the amount of the enzyme present in the composition will have little if any effect on the ability of the composition to decompose waste.

A solid composition for decomposing waste containing the alkyl-diazalheptanic acid, the protease enzyme and the cellulase enzyme is feasible but with suitable carriers compounds replacing the stabilizing

compounds and the water. However, the carrier compounds in the solid composition must be at least 3 times the amount used in the liquid composition. This is because the disinfecting agent, alkyl-diazalheptanic acid, is only available in liquid form, and without the stabilizing compounds the enzymes are not stable in solution. Therefore, three times the amount of the carriers are used in the solid composition as compared to the disinfectant. In addition, as in the liquid composition, the enzymes are used in the same proportion as the disinfecting agent. Thus, the amount of the carrier compounds used is also three times the amount of the enzymes employed in the solid composition, as compared to the liquid composition.

The protease and cellulase enzymes used in the solid composition are in granular form. The carriers in the solid composition can be any known carrier. Preferably the carriers do not have an extreme pH, are not hydroscopic and are environmentally friendly. Examples of carrier compounds that are suitable for the solid composition are compounds selected from the group consisting of phosphates, sodium bicarbonate, sodium sulfate, sodium borates and combinations thereof. Compounds employed as carriers should not be limited to the above mentioned compounds, but to compounds that can act as effective carriers. Persons skilled in the art can determine if a compound is a suitable carrier. All such compounds are included in the scope of this invention. Depending on the carriers used, the solid composition is non-toxic, biodegradable and in other ways environmentally friendly.

According to a preferred embodiment of the present invention, the alkyl-diazalheptanic acid in the solid composition has an alkyl group of

between approximately 8 to approximately 14 carbons in length. Further, in a more preferred composition, the alkyl-diazalheptanic acid in the solid composition has an alkyl group of approximately 12 carbons in length.

The liquid enzymatic composition for treating septic systems is prepared by a method comprising the steps of: preparing a solution comprising a boron compound, a poly-alcohol compound, an alkali metal salt and water. After the first solution has been thoroughly mixed by agitating the mixture, sufficient amounts of protease enzyme, cellulase enzyme and alkyl-diazalheptanic acid are added to the first solution.

The alkyl group present in the alkyl-diazalheptanic acid preferably has between approximately 8 and approximately 14 carbons, and most preferably approximately 12 carbons.

The poly-alcohol preferably is selected from the group consisting of ethylene glycol, propylene glycol, 1,2-propanediol, butylene glycol, hexylene glycol, glycerine, mannitol, sorbitol, erythritol, glucose fructose, lactose, erythritol-1,4-anhydride and mixtures thereof. Most preferably glycerine is used.

The alkali metal salt is preferably sodium chloride. The boron compound is preferably selected from the group consisting of boric acid, boric oxide and alkali metal borates. The alkali metal borate is most preferably sodium borate (borax).

The boron compound is preferably used in an amount between approximately 3% to approximately 5% by weight, and most preferably approximately 3% by weight. The poly-alcohol compound is preferably used in an amount between approximately 8% to approximately 20% by

weight, and most preferably approximately 10% by weight. The alkali metal salt is preferably used in an amount between approximately 4% to approximately 10% by weight, and most preferably approximately 4% by weight. The cellulase enzyme is preferably used in an amount between approximately 1% to approximately 4% by weight, and most preferably approximately 2% by weight. The protease enzyme is preferably used in an amount between approximately 0.5% to approximately 2% by weight, and most preferably approximately 1% by weight. The alkyl-diazalheptanic acid is preferably used in an amount between approximately 20% to approximately 30% by weight, and most preferably approximately 25% by weight. The water is preferably used in an amount up to approximately 70%.

The most preferred method for preparing the liquid composition for decomposing waste in a septic system is as follows:

1. Dissolving 30 grams of sodium borate in 100 grams of glycerine with slow agitation to form a first solution.

2. Adding approximately 275 grams of H_2O to the first solution to form a second solution.

3. Dissolving 40 grams of sodium chloride in the second solution, to form a third solution.

4. Adding 250 grams of 20% alkyl-diazalheptanic acid, wherein the alkyl group of the diazalheptanic acid is a straight chain of twelve carbons, under slow agitation to the third solution, to form the fourth solution.

5. Adding 20 grams of liquid cellulase under moderate agitation to the fourth solution. The agitation is continued for at least 5 minutes to form the fifth solution.

6. Adding 10 grams of liquid protease under moderate agitation to the fifth solution to form a sixth solution.

7. Adding a sufficient amount of water to bring weight to 1000 grams.

The above procedure may be varied, however, it is essential that the stabilizing compounds be present in the solution prior to the addition of the enzymes. Otherwise, the enzymes are subject to destabilization. Furthermore, the procedure is not specific to the point of adding the diazalheptanic acid before or after the enzymes. The diazalheptanic acid can be added at any time so long as the stabilizing compounds are present in the solution when the enzymes are exposed to the acid and/or the water. Therefore, the procedure is not specific as to the dissolving of different compounds in a specific order. Thus, steps 1, 2 and 3 may be performed in one step.

The solid composition is prepared by mixing the dry, solid carriers, the liquid disinfectant alkyl-diazalheptanic acid, and the protease and cellulase enzyme granulates. The liquid alkyl-diazalheptanic acid is preferably added by dripping or spraying the liquid onto the solid mixture. It is important to note that the enzyme granulates should be added after the spraying or dripping of any liquid that may be involved in the preparation. The alkyl-diazalheptanic acid composition preferred is the same as that preferred in the liquid composition.

According to a further embodiment of the present invention, the enzymatic composition is used in a method for decomposing waste in a septic system. The method for decomposing waste with a liquid composition in a septic system comprises forming an enzymatic composition by combining a boron compound, a poly-alcohol compound, an alkali metal salt, a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and water. Once the composition has been formed, the composition is added to a septic system. Waste, such as paper and feces, is collected in the septic system and the waste collected is contacted with the enzymatic composition prepared. The enzymatic composition acts to decompose, disinfect and deodorize the waste collected in the septic system. The liquid composition prepared is described in detail above.

The method for decomposing waste with a solid composition in a septic system comprises forming an enzymatic composition by combining a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and suitable carrier compounds. Once the solid composition has been formed, a sufficient amount of water to dissolve the solid composition is added. After the solid composition has dissolved, the mixture is added to a septic system. Waste, such as paper and feces, is collected in the septic system and the waste collected is contacted with the enzymatic composition prepared. The enzymatic composition acts to decompose, disinfect and deodorize the waste collected in the septic system. The solid composition prepared is described in detail above.

The septic system is preferably a portable septic system, such as a portable toilet such as are used at construction sites, outdoor events

where crowds are expected, or for toilets used in connection with vehicles, such as toilets on motorhomes, caravans, buses, trains, airplanes and ships. As seen in Figures 1 and 2, a portable toilet includes a housing 12, a toilet portion 14 in fluid communication with a collecting reservoir 16, typically, below toilet portion 14. The enzymatic composition 18 is placed in collecting reservoir 16 where it will contact the waste received in toilet portion 14.

The enzymatic composition used to decompose waste in the septic system may be added to any area of the septic system so long as the waste is sufficiently exposed to the composition to allow decomposition and disinfection to take place. In a portable toilet, the composition is added to the collecting container beneath the receiving means. Also, to provide disinfecting and deodorizing of the receiving means, it is preferred that the composition be contacted with the receiving means. In more elaborate portable toilets, the enzymatic composition may be used to flush a toilet bowl after each use so that when the toilet is flushed, the enymatic composition is washed with the waste through the receiving means and into the collecting means. Ultimately, however, the enzymatic composition is preferably exposed to any area of the septic system where it is useful to decompose, disinfect or deodorize the waste.

The present invention allows the waste in the septic system to be safely discarded in a normal sewer system without disturbing the biological balance of the sewer system. Furthermore, the resulting decomposed waste/enzymatic solution is non-toxic and environmentally safe. The waste can be safely and easily removed from the septic system, allowing for convenient disposal.

It will be clear to those skilled in the art of waste disinfecting and deodorizing solutions that many modifications and substitutions can be made to the composition and its various methods of use described above without departing from the spirit and scope of the invention, which is defined by the appended claims.

CLAIMS

WHAT IS CLAIMED IS:

1. A composition for treating waste in a septic system, said composition comprising:

(a) between approximately 20% and approximately 30% by weight of an approximately 20% solution of alkyl-diazalheptanic acid;

(b) between approximately 8% and approximately 20% by weight poly-alcohol;

(c) between approximately 4% and approximately 10% by weight alkali metal salt;

(d) between approximately 3% and approximately 5% by weight of a boron compound;

(e) between approximately 0.5% and approximately 2% by weight protease enzyme;

(f) between approximately 1% and approximately 4% by weight cellulase enzyme; and

(g) water.

2. A composition as recited in claim 1, wherein said alkyl-diazalheptanic acid has an alkyl group of between approximately 8 to approximately 14 carbons.

3. A composition as recited in claim 1, wherein said alkyl-diazalheptanic acid has an alkyl group of 12 carbons.

4. A composition as recited in claim 1, wherein said poly-alcohol is selected from the group consisting of ethylene glycol, propylene glycol, 1,2-propanediol, butylene glycol, hexylene glycol, glycerine, mannitol, sorbitol, erythritol, glucose fructose, lactose, erythritol-1,4-anhydride and mixtures thereof.

5. A composition as recited in claim 1, wherein said poly-alcohol is glycerine.

6. A composition as recited in claim 1, wherein said alkali metal salt is sodium chloride.

7. A composition as recited in claim 1, wherein said boron compound is selected from the group consisting of boric acid, boric oxide and alkali metal borates.

8. A composition as recited in claim 1, wherein said boron compound is sodium borate.

9. A composition as recited in claim 1, wherein said composition contains approximately 25% by weight of a 20% solution of alkyl-diazalheptanic acid.

10. A composition as recited in claim 1, wherein said composition contains approximately 10% by weight of said poly-alcohol.

11. A composition as recited in claim 1, wherein said composition contains approximately 4% by weight of said alkali metal salt.

12. A composition as recited in claim 1, wherein said composition contains approximately 3% by weight of said boron compound.

13. A composition as recited in claim 1, wherein said composition contains approximately 1% by weight of said protease enzyme.

14. A composition as recited in claim 1, wherein said composition contains approximately 2% by weight of said cellulase enzyme.

15. A composition for treating waste in a septic system, said composition comprising:

(a) between approximately 7% and approximately 14% by weight of an approximately 20% solution of alkyl-diazalheptanic acid;

(b) between approximately 0.1% and approximately 1% by weight of a protease enzyme;

(c) between approximately 0.4% and approximately 1.7% by weight of a cellulase enzyme; and

(d) between approximately 84% and approximately 92% by weight carrier compounds.

16. A method for preparing a composition for decomposing waste in a septic system, said method comprising the steps of:

(a) preparing a first solution comprising a boron compound, a poly-alcohol compound, an alkali metal salt, and water;

(b) agitating said first solution; and

(c) adding a protease enzyme, a cellulase enzyme and an alkyl-diazalheptanic acid to said first solution.

17. A method as recited in claim 16, wherein said alkyl-diazalheptanic acid has an alkyl group of between approximately 8 to approximately 14 carbons.

18. A method as recited in claim 16, wherein said poly-alcohol is selected from the group consisting of ethylene glycol, propylene glycol, 1,2-propanediol, butylene glycol, hexylene glycol, glycerine, mannitol, sorbitol, erythritol, glucose fructose, lactose, erythritol-1,4-anhydride and mixtures thereof.

19. A method as recited in claim 16, wherein said alkali metal salt is sodium chloride.

20. A method as recited in claim 16, wherein said boron compound is selected from the group consisting of boric acid, boric oxide and alkali metal borates.

21. A method as recited in claim 16, wherein said alkyl-diazalheptanic acid has an alkyl group of 12 carbons.

22. A method as recited in claim 16, wherein said poly-alcohol is glycerine.

23. A method as recited in claim 16, wherein said boron compound is sodium borate.

24. A method as recited in claim 16, wherein said composition contains between approximately 3% to approximately 5% by weight of said boron compound, between approximately 8% to approximately 20% by weight of said poly-alcohol, between approximately 4% to approximately 10% by weight of said alkali metal, between approximately 1% to approximately 4% by weight of said cellulase enzyme, between approximately 0.5% to approximately 2% by weight of said protease enzyme, between approximately 20% to approximately 30% of an approximately 20% solution of said alkyl-diazalheptanic acid and up to approximately 70% of said water.

25. A method as recited in claim 16, wherein said composition contains approximately 3% of said boron compound, approximately 4% of said alkali metal salt, approximately 10% of said poly-alcohol, approximately 1% of said protease enzyme, approximately 2% of said cellulase enzyme, approximately 25% of an approximately 20% solution of said alkyl-diazalheptanic acid, and said water is up to approximately 70%.

26. A method of decomposing waste in a septic system, said method comprising the steps of:

(a) combining a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and carriers to form a composition;

(b) adding said composition to said septic system;

(c) collecting said waste in said septic system; and

(d) contacting said waste in said septic system with said composition, so that the enzymatic composition decomposes said waste in said septic system.

27. A method as recited in claim 26, wherein said septic system is a portable septic system.

28. A method as recited in claim 26, wherein the decomposed waste is disposed in a conventional sewer system.

29. A method as recited in claim 26, wherein said carriers are a boron compound, a poly-alcohol compound, an alkali metal salt and water.

30. A method as recited in claim 29, wherein said alkyl-diazalheptanic acid has an alkyl group of between approximately 8 to approximately 14 carbons; said poly-alcohol is selected from the group consisting of ethylene glycol, propylene glycol, 1,2-propanediol, butylene glycol, hexylene glycol, glycerine, mannitol, sorbitol, erythritol, glucose fructose, lactose, erythritol-1,4-anhydride and mixtures thereof; said

alkali metal salt is sodium chloride; and said boron compound is selected from the group consisting of boric acid, boric oxide and alkali metal borates.

31. A method as recited in claim 29, wherein said alkyl-diazalheptanic acid has an alkyl group of 12 carbons, said poly-alcohol is glycerine, said boron compound is sodium borate and said alkali metal salt is sodium chloride.

32. A method as recited in claim 29, wherein said composition contains between approximately 3% to approximately 5% by weight of said boron compound, between approximately 8% to approximately 20% by weight of said poly-alcohol, between approximately 4% to approximately 10% by weight of said alkali metal, between approximately 1% to approximately 4% by weight of said cellulase enzyme, between approximately 0.5% to approximately 2% by weight of said protease enzyme, between approximately 20% to approximately 30% of an approximately 20% solution of said alkyl-diazalheptanic acid, and up to approximately 70% of said water.

33. A method as recited in claim 29, wherein said composition contains approximately 3% boron compound, approximately 4% of said alkali metal salt, approximately 10% of said poly-alcohol, approximately 1% of said protease enzyme, approximately 2% of said cellulase enzyme, approximately 25% of an approximately 20% solution of said alkyl-diazalheptanic acid, and up to approximately 70% of said water.

34. A method as recited in claim 26, further comprising the step of dissolving said composition in water before said composition is added to said septic system.

35. A septic system for collecting and decomposing waste, said septic system comprising:

(a) a toilet for receiving waste;

(b) means for collecting waste in fluid communication with said toilet; and

(c) a composition in said toilet and said collecting means, said composition including a protease enzyme, a cellulase enzyme, an alkyl-diazalheptanic acid and carrier compounds.

36. A septic system as recited in claim 35, wherein said carrier compounds are a boron compound, a poly-alcohol compound, an alkali metal salt and water.

37. A septic system as recited in claim 35, wherein said composition is dissolved in water.

38. A septic system as recited in claim 35, wherein said septic system is a portable septic system.

39. A septic system as recited in claim 35, wherein said septic system further comprises a housing dimensioned to contain said toilet and

said collecting means, wherein said collecting means in fluid communication with said toilet is below said toilet.

Fig 1

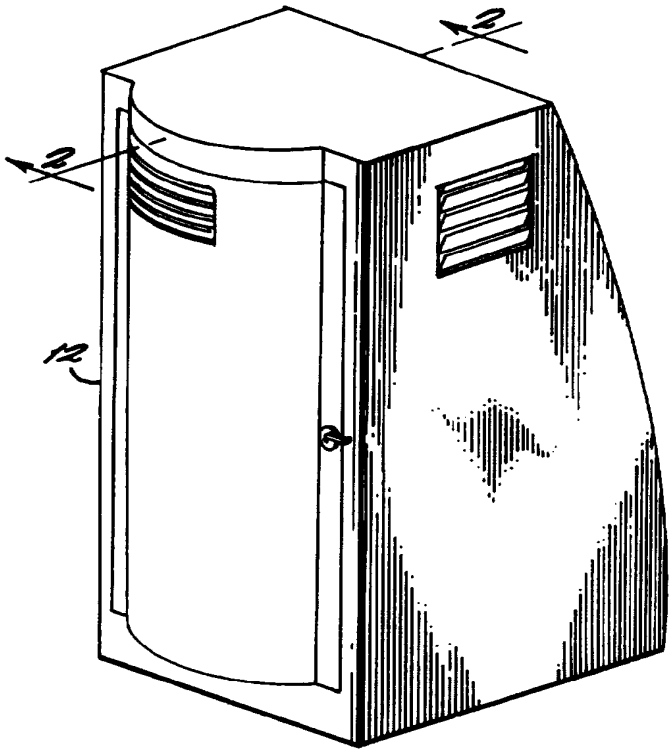
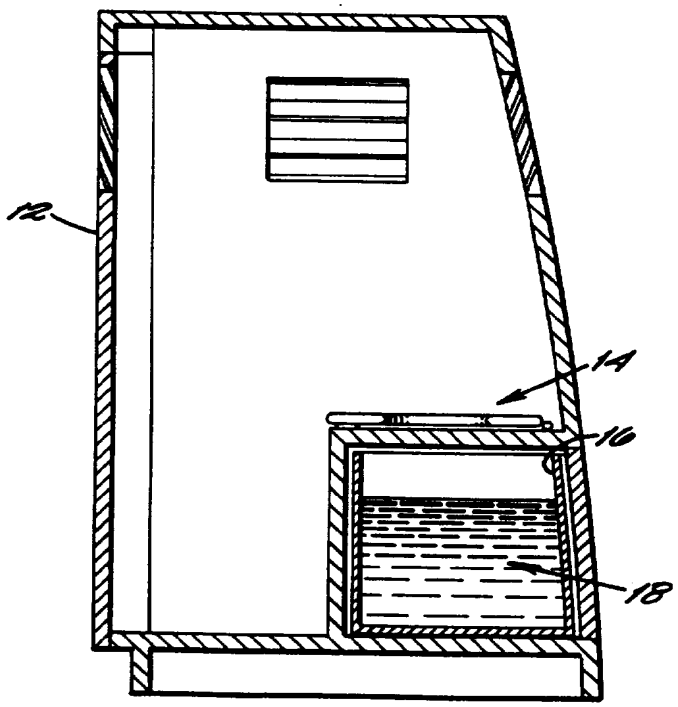


Fig 2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/00337

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B01D 33/00; C02F 1/00; C12N 9/42, 9/50; C07G 15/00, 17/00
US CL :210/209, 632; 435/209, 219, 267, 268
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 210/209, 632; 435/209, 219, 267, 268

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, REGISTRY, CAS, WPIDS
Search terms: diazalhept?, diazal?, diazohept?, diazahept?, disinfect,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
NONE	NONE	NONE

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 20 MARCH 1996	Date of mailing of the international search report 02 APR 1996
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Deborah Frieste /JP JON P. WEBER, PH.D. Telephone No. (703) 308-0196

Form PCT/ISA/210 (second sheet)(July 1992)★

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/00337

BOX I. OBSERVATIONS WHERE CLAIMS WERE FOUND UNSEARCHABLE

2. Where no meaningful search could be carried out, specifically:

It was not possible to search the claimed invention, because the key ingredient alleged to provide novelty over the references cited in the background is the "alkyl-diazalheptanic acid" which itself was unsearchable. There was insufficient description of this compound in the description disclosure to search it. An attempt was made to find a registry number for this compound by guessing at alternative spellings, but no compound even remotely related to this spelling was found.